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Using the Density-Matrix Renormalization Group to Explore a Proposed Hamiltonian for Volborthite EDWARD PARKER, Univ of California - Santa Barbara — Volborthite ($Cu_3V_2O_7(OH)_2 \cdot 2H_2O$) is a strongly geometrically frustrated sytem of spin-1/2 ions on a Kagomé lattice whose magnetic ordering temperature is more than two orders of magnitude below its Curie temperature. Measurements of its magnetization curve show an extremely broad magnetization plateau extending over a range of at least 100 Tesla. Density functional theory calculations suggest a nontrivial anisotropic spin coupling structure with both ferromagnetic and antiferromagnetic bonds. Prior studies of similar (but simpler) systems suggest the possibility of a spin nematic phase containing gapless bound states of two or more magnons, which can condense and spontaneously break the $U(1)$ spin symmetry about the applied field down to a discrete cyclic symmetry. We will report Density-Matrix Renormalization Group studies of this model to investigate plateau formation and possible spin nematic and spin density wave phases. Techniques include approximating the full 2-D lattice using interchain mean-field theory and spin ladders.

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